



# College Algebra with Corequisite Support: A Targeted Review

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Alta College Algebra with Corequisite Support: A Targeted Review is a one-semester course that hinges on the college-level outcomes for College Algebra, but also offers the opportunity for targeted, discrete review assignments at a lower level to help prepare some students for the college-level material that constitutes their ultimate objective in College Algebra.

To develop the course, Knewton used four main sources of content: Openstax, videos created by a Math Professor we have partnered with, the Open Textbook Library, and a team of Subject Matter Experts (SMEs). The SMEs come from diverse backgrounds and are all accomplished academics in the field of Mathematics.

Alta College Algebra with Corequisite Support: A Targeted Review has two instructional sequences for every learning objective, giving students multiple opportunities to learn new concepts. Alta College Algebra with Corequisite Support: A Targeted Review covers the typical breadth of college algebra topics, and also provides the necessary depth to ensure the course is manageable and engaging for instructors and students alike.

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### College Algebra

#### Chapter 1: Prerequisites

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  - Distinguish between rational and irrational numbers
  - Perform calculations using order of operations
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  - Use the commutative, associative, and distributive properties of real numbers
- Evaluate and Simplify Algebraic Expressions
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  - Evaluate algebraic expressions with two variables
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  - Simplify algebraic expressions

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### 1.3 Radicals and Rational Exponents

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  - Factor expressions using fractional or negative exponents
  - Factor expressions using greatest common factor and other technique

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    - Multiply rational expressions
    - Divide rational expressions
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  - Solve equations in one variable algebraically, variable on both sides
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  - Solve a rational equation, binomials in denominator
  - Solve a rational equation, requires factoring to find least common denominator
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  - Understand the relationship between the slope and y-intercept of a line and its equation
  - Find x -intercepts and y -intercepts
- Find Linear Equations
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    - Simplify powers of  $i$
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- Operations on Complex Numbers
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  - Multiply a complex number by a real number
  - Multiply two complex numbers
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  - Solve quadratic equations by completing the square
- Quadratic Formula
  - Use the discriminant to classify the solutions of a quadratic equation
  - Solve quadratic equations by using the quadratic formula

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- Absolute Value Equations and Inequalities
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## 2.8 Inequalities Requiring Factoring

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  - Evaluate or solve a function from a graph

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  - Use a graph to locate the absolute maximum and absolute minimum
- Difference Quotients
  - Determine the difference quotient

### 3.4 Composition of Functions

- Combinations of Functions
  - Combine functions using algebraic operations
  - Create a new function by composition of functions
- Evaluate Composite Functions
  - Evaluate composite functions given a table of values
  - Evaluate composite functions given the graph of functions
  - Evaluate composite functions given explicit functions
- Properties of Composite Functions
  - Find the domain of a composite function
  - Decompose a composite function into its component functions

### 3.5 Function Graphs and Transformations

- Transformations of Functions
    - Graph functions using vertical and horizontal shifts
    - Graph functions using reflections about the x-axis and the y-axis
-

- Graph functions using compressions and stretches
- Combine transformations
- Even and Odd Functions
  - Determine whether a function is even, odd, or neither from its graph
  - Determine whether a function is even, odd, or neither given algebraically

### 3.6 Absolute Value Functions

- Graph Absolute Value Functions
  - Graph an absolute value function

### 3.7 Inverse Functions

- Inverse Function Values
  - Verify inverse function ordered pairs
  - Given graph of a function, find value of inverse function
  - Given table of values of a function, find value of inverse function
- Find Inverse Functions
  - Verify inverse function pairs algebraically
  - Determine the domain and range of an inverse function, and restrict the domain of a function to make it one-to-one
  - Given function, find the inverse function
  - Use the graph of a one-to-one function to graph its inverse function on the same axes

## Chapter 4: Linear Functions and Modeling

### 4.1 Linear Functions

- Interpretations of Linear Functions
  - Represent a linear function in table form
  - Determine whether a linear function is increasing, decreasing, or constant
  - Interpret slope as a rate of change
  - Represent a real-world application as a linear function
  - Graph linear functions

### 4.2 Modeling with Linear Functions

- Application of Linear Functions
  - Build linear models from verbal descriptions, given a y-intercept
  - Build linear models from verbal descriptions, given inputs and outputs
  - Use a diagram to build a model
  - Model a set of data with a linear function

### 4.3 Fitting Linear Models to Data

- Scatter Diagrams and Lines of Best Fit
  - Draw and interpret scatter diagrams
  - Distinguish between linear and nonlinear relations

## Chapter 5: Polynomial and Rational Functions

### 5.1 Quadratic Functions

- Con
    - Determine axis of symmetry and vertex of parabolas from a graph
    - Determine x- and y-intercepts of parabolas from a graph
-

- Find the direction a parabola opens and its axis of symmetry and vertex from the general form of its equation
- Identify the axis of symmetry and vertex of a parabola from its equation in standard form
- Graphs of Quadratic Functions
  - Write the equation of a quadratic function given vertex and a point on a graph
  - Write the equation of a quadratic function given intercepts on a graph
  - Write the equation of a quadratic function in standard form given the equation in general form
- Applications of Quadratic Functions
  - Find the domain and range of a quadratic function
  - Determine the maximum and minimum values of quadratic functions
  - Find the x- and y-intercepts of a quadratic function
  - Use a quadratic function to model projectile motion

## 5.2 Graphs of Polynomial and Power Functions

- End Behavior of Polynomial Functions
  - Identify power functions and polynomial functions
  - Identify if a graph is a polynomial function
  - Determine end behavior
- Local Behavior of Polynomial Functions
  - Identify intercepts of polynomial functions in factored form
  - Understand the relationship between degree, turning points, and x-intercepts
  - Understand the intermediate value theorem
  - Use factoring to find zeros of polynomial functions
  - Identify zeros and their multiplicities from an equation or a graph
- Write and Graph Polynomial Functions
  - Draw conclusions about a polynomial function from a graph
  - Graph polynomial functions
  - Write a formula for a polynomial function from a graph
  - Determine equation of a polynomial given key information

## 5.3 Dividing Polynomials

- Long Division of Polynomials
  - Use long division to divide polynomials
  - Use polynomial division to solve application problems
- Synthetic Division and Remainder Theorem
  - Use synthetic division to divide polynomials
  - Evaluate a polynomial using the remainder theorem

## 5.4 Zeros of Polynomial Functions

- Rational Zeros of Polynomial Functions
    - Use the factor theorem to solve a polynomial equation
    - Use the rational zero theorem to find rational zeros
    - Solve real-world applications of polynomial equations
-

- Complex Zeros of Polynomial Functions
  - Find zeros of polynomial functions with complex zeros
  - Use the linear factorization theorem to find polynomials with given zeros
  - Use Descartes' rule of signs

#### 5.5 Rational Functions

- Asymptotic Behavior of Rational Functions
  - Use arrow notation to describe local behavior and end behavior of rational functions
  - Identify vertical asymptotes and removable discontinuities of rational functions
  - Identify horizontal and slant asymptotes of rational functions
- Graphs and Applications of Rational Functions
  - Solve applied problems involving rational functions
  - Find the intercepts of a rational function
  - Graph rational functions
  - Find the equation of a rational function from a graph

#### 5.6 Inverses and Radical Functions

- Inverses of Polynomial Functions
  - Find the inverse of an invertible polynomial function
  - Restrict the domain to find the inverse of a polynomial function
  - Solve an application with the inverse of a function
- Inverses of Radical and Rational Functions
  - Find the inverse of a radical function
  - Find the domain of a radical function composed with a rational function
  - Find the inverse of a rational function

#### 5.7 Modeling Using Variation

- Direct and Inverse Variation
  - Solve direct variation problems
  - Solve inverse variation problems
  - Solve problems involving joint variation

#### 5.8 Circles

- Graphs of Circles
  - Given the equation of a circle not in standard form, determine the standard form by completing the square
  - Determine the center and radius of a circle from the standard equation of a circle and sketch its graph

### Chapter 6: Exponential and Logarithmic Functions

#### 6.1 Exponential Functions

- Evaluate and Write Exponential Functions
    - Identify exponential functions
    - Evaluate exponential functions
    - Find the equation of an exponential function given the initial value and a point
    - Find the equation of an exponential function when the initial value is not known
-

- Applications of Exponential Functions and Base  $e$ 
  - Find the equation of an exponential function in a word problem context
  - Calculate compound interest
  - Evaluate exponential functions with base  $e$
  - Calculate continuous growth and decay

## 6.2 Graphs of Exponential Functions

- Exponential Function Graphs
  - Graph exponential functions
  - Graph exponential functions using transformations
  - Find the equation of an exponential function given a graph
  - Write an exponential function from a description

## 6.3 Logarithmic Functions

- Relate Logarithms and Exponents
  - Convert from logarithmic to exponential form
  - Convert from exponential to logarithmic form
- Evaluate Logarithmic Expressions
  - Evaluate logarithms with positive integer solutions
  - Evaluate logarithms with negative integer solutions
  - Use common logarithms
  - Use natural logarithms

## 6.4 Graphs of Logarithmic Functions

- Logarithmic Function Graphs
  - Identify the domain of a logarithmic function
  - Graph logarithmic functions
  - Graph transformations of logarithmic functions
  - Write a logarithmic function from a description

## 6.5 Logarithmic Properties

- Basic Properties of Logarithms
  - Understand the basic properties of logarithms
  - Use the product rule for logarithms
  - Use the quotient rule for logarithms
  - Use the power rule for logarithms
- Rewrite Logarithmic Expressions Using Properties
  - Expand logarithmic expressions
  - Condense logarithmic expressions
  - Use the change-of-base formula for logarithms

## 6.6 Exponential and Logarithmic Equations

- Solve Exponential Equations
    - Use like bases to solve exponential equations
    - Rewrite equations so all powers have the same base and solve exponential equations
    - Use logarithms to solve exponential equations
    - Solve an equation with a base  $e$  using natural logarithms
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- Solve Logarithmic Equations
  - Use the definition of a logarithm to solve logarithmic equations
  - Use logarithm properties and the definition of the logarithm to solve logarithmic equations
  - Use the one-to-one property of logarithms to solve logarithmic equations

#### 6.7 Exponential and Logarithmic Models

- Applications of Exponential and Logarithmic Functions
  - Model exponential growth
  - Model exponential decay
  - Applied logarithmic models
  - Choose an appropriate model for data
  - Express an exponential model in base  $e$

### Chapter 7: Systems of Equations and Inequalities

#### 7.1 Systems of Linear Equations in Two Variables

- Graphing Systems of Linear Equations
  - Determine whether an ordered pair is a solution to a system of equations
  - Solve systems of equations in two variables by graphing
- Solving Systems of Linear Equations
  - Solve systems of equations in two variables by substitution
  - Solve systems of equations in two variables by addition
  - Identify inconsistent and dependent systems of equations containing two variables, and express the solution of dependent equations
- Applications of Systems of Linear Equations
  - Use systems of equations to investigate profits
  - Write and solve a system of equations in two variables from a word problem
- Linear Inequalities in Two Variables
  - Solve a linear inequality in two variables by graphing
  - Solve a linear system of inequalities by graphing

#### 7.2 Systems of Linear Equations in Three Variables

- Systems of Linear Equations in Three Variables
  - Determine whether an ordered triple is a solution to a system
  - Solve systems of three equations in three variables
  - Identify inconsistent and dependent systems of equations containing three variables, and express the solution of a system of dependent equations

#### 7.3 Systems of Nonlinear Equations in Two Variables

- Systems of Two Nonlinear Equations
    - Solve a system of nonlinear equations representing a parabola and a line
    - Solve a system of nonlinear equations representing a circle and a line
    - Solve a system of nonlinear equations in two variables using elimination
  - Graphing Nonlinear Inequalities and Systems of Inequalities
    - Graph a nonlinear inequality
    - Graph a system of nonlinear inequalities
-

#### 7.4 Partial Fractions

- Partial Fraction Decomposition with Linear Factors
  - Decompose a rational expression where the denominator has only nonrepeated linear factors
  - Decompose a rational expression where the denominator has repeated linear factors
- Partial Fraction Decomposition with Quadratic Factors
  - Decompose a rational expression where the denominator has a nonrepeated irreducible quadratic factor
  - Decompose a rational expression where the denominator has a repeated irreducible quadratic factor

#### 7.5 Matrices and Matrix Operations

- Introduction to Matrices
  - Determine the order of a matrix and describe elements within a matrix
  - Add or subtract matrices
- Matrix Multiplication
  - Multiply a matrix by a scalar
  - Find the sum or difference of scalar multiples
  - Multiply two matrices

#### 7.6 Augmented Matrices and Gaussian Elimination

- Solving Systems with Gaussian Eliminations
  - Convert between a system of equations and its corresponding augmented matrix
  - Use row operations to solve a system of linear equations in two variables
  - Use row operations to solve a system of linear equations in three variables
  - Use matrices to solve applications of systems of linear equations

#### 7.7 Determinants of Matrices and the Inverse Matrix

- Finding Determinants of Matrices
  - Find the determinant of a  $2 \times 2$  matrix
  - Find the determinant of a  $3 \times 3$  matrix
- Inverse and Identity Matrices
  - Understand the identity matrix and how it relates to the inverse matrix
  - Determine if a matrix is invertible using the determinant
  - Find the inverse of a  $2 \times 2$  matrix
  - Find the inverse of a  $3 \times 3$  matrix
- Solving Systems with Inverses
  - Solve a system of linear equations using the inverse of a  $2 \times 2$  matrix
  - Solve a system of linear equations using the inverse of a  $3 \times 3$  matrix

#### 7.8 Cramer's Rule

- Solving Systems with Cramer's Rule
    - Use Cramer's rule to solve a system of two equations in two variables
    - Use Cramer's rule to solve a system of three equations in three variables
    - Use Cramer's rule to solve inconsistent or dependent systems
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## Chapter 8: Conic Sections

### 8.1 Ellipses

- Ellipses Centered at the Origin
  - Identify key points and axes of ellipses from a graph
  - Identify key points and axes of ellipses from an equation
  - Write the equation in standard form of an ellipse centered at the origin
  - Graph an ellipse centered at the origin from an equation in standard form
- Ellipses Not Centered at the Origin
  - Identify key points and axes of ellipses not centered at the origin
  - Write the equation in standard form of an ellipse not centered at the origin
  - Graph an ellipse not centered at the origin
- Ellipses Not in Standard Form and Applications of Ellipses
  - Convert an equation of an ellipse into standard form
  - Graph an ellipse where the equation is not given in standard form
  - Use ellipses in applications

### 8.2 Hyperbolas

- Hyperbolas Centered at the Origin
  - Locate the vertices and foci of a hyperbola from a graph
  - Identify vertices, foci, and asymptotes of a hyperbola from an equation
  - Write the equation of a hyperbola centered at the origin in standard form
  - Graph a hyperbola centered at the origin from an equation in standard form
- Hyperbolas Not Centered at the Origin
  - Identify vertices, foci, and asymptotes of a hyperbola not centered at the origin
  - Write the equation of a hyperbola not centered at the origin
  - Graph a hyperbola not centered at the origin from an equation in standard form
- Hyperbolas Not in Standard Form and Applications of Hyperbolas
  - Convert an equation of a hyperbola into standard form
  - Graph a hyperbola from an equation given in general form
  - Use hyperbolas in applications

### 8.3 Parabolas

- Parabolas Centered at the Origin
    - Identify key components of a parabola from a graph
    - Identify key components of a parabola from an equation
    - Graph a parabola centered at the origin
    - Write the equation of a parabola centered at the origin in standard form
  - Parabolas Not Centered at the Origin
    - Identify key components of a parabola not centered at the origin
    - Graph a parabola not centered at the origin
    - Write the equation of a parabola not centered at the origin in standard form
  - Parabolas Not in Standard Form and Applications of Parabolas
    - Convert an equation of a parabola into standard form
    - Graph a parabola from an equation given in general form
    - Use parabolas in applications
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## Chapter 9: Sequences and Series

### 9.1 Sequences

- Introduction to Sequences
  - Write the terms of a sequence defined by an explicit formula
  - Write the terms of a sequence defined by a piecewise explicit formula
- Recursive Sequences
  - Write the terms of a sequence defined by a recursive formula
  - Write the terms of a sequence defined by a recursive formula with more than one initial term

### 9.2 Arithmetic Sequences

- Arithmetic Sequences
  - Find the common difference of an arithmetic sequence
  - Write terms of an arithmetic sequence
  - Write a recursive formula for an arithmetic sequence
  - Write an explicit formula for an arithmetic sequence
- Applications of Arithmetic Sequences
  - Find specific terms of an arithmetic sequence given other terms
  - Solve application problems with arithmetic sequences

### 9.3 Geometric Sequences

- Geometric Sequences
  - Find the common ratio of a geometric sequence
  - Write terms of a geometric sequence
  - Write a recursive formula for a geometric sequence
  - Write an explicit formula for a geometric sequence
- Applications of Geometric Sequences
  - Write an explicit formula for the  $n$ th term of a sequence
  - Solve application problems with geometric sequences
  - Solve geometric sequence problems

### 9.4 Series

- Summation Notation and Arithmetic Series
    - Evaluate expressions using summation notation
    - Find the sum of a finite arithmetic series
  - Finite and Infinite Geometric Series
    - Find the sum of a finite geometric series
    - Determine if the sum of an infinite series is defined
    - Find the sum of an infinite geometric series
  - Applications of Series
    - Solve application problems with arithmetic series
    - Solve application problems with geometric series
    - Find the equivalent fraction for a repeating decimal
    - Solve an annuity problem
-

### 9.5 Counting Theory

- The Addition and Multiplication Principles
  - Solve counting problems using the addition principle
  - Solve counting problems using the multiplication principle
  - Evaluate an expression with factorials
- Permutations
  - Find the number of permutations of  $n$  distinct objects using the multiplication principle
  - Find the number of permutations of  $n$  distinct objects using a formula
  - Find the number of permutations of  $n$  non-distinct objects
- Combinations
  - Find the number of combinations using the formula
  - Find the number of subsets of a set

### 9.6 Binomial Theorem

- Binomial Expansion
  - Find a binomial coefficient
  - Expand a binomial using the binomial theorem
  - Use the binomial theorem to find a single term

### 9.7 Probability

- Basic Probability
    - Compute the probability of equally likely outcomes
    - Compute the probability of the union of two events
    - Use the complement rule to compute probabilities
    - Compute probability using counting theory
-